The High Energy Light Isotope eXperiment (HELIX): Ohio State Tasks

Completed Technology Project (2017 - 2020)

Project Introduction

We propose to join the High Energy Light Isotope eXperiment (HELIX), a balloon-borne magnetic spectrometer designed to measure the isotopic composition of cosmic ray nuclei from hydrogen to neon, with particular emphasis on the important Be-10/Be-9 `'clock' isotopic ratio.HELIX is a collaborative experiment headed by Scott Wakely (Chicago), with collaborators from Indiana University, Michigan, Penn State, and Northern Kentucky University. The HELIX instrument is designed to make measurements of the composition of light cosmic rays in the energy range from below 1 GeV/n to 5 GeV/n in its initial phase, with a specific emphasis on the determination of astrophysically important isotopic abundance ratios. Measurements of this kind at lower energies have in the past provided profound insights into the nature and origin of cosmic rays, revealing, for instance, information about acceleration and confinement timescales, and exposing some conspicuous discrepancies between solar and cosmic-ray abundances. We propose to contribute to HELIX by enhancing the mass resolution of the instrument and thus the range of masses and energies that can be studied, and by laying the technical foundation for extended operation of the magnet for a full 14-day Antarctic flight. The mass resolution will be enhanced by improving the rigidity resolution of the spectrometer by adding high-resolution silicon-strip tracking sensors repurposed from the Fermilab CDF inner tracker to augment the drift chamber, and by increasing the number of sensors in the RICH focal plane from 175 to 275. We will also develop an in-flight helium transfer process and demonstrate this capability in a CONUS test flight, and prepare a design for an auxiliary helium dewar and in-flight helium transfer system for use in future HELIX flights. This proposal is responsive to NASA's Strategic Objective 1.6: "Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars."

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

Ohio State University-Main Campus

Responsible Program:

Astrophysics Research and Analysis

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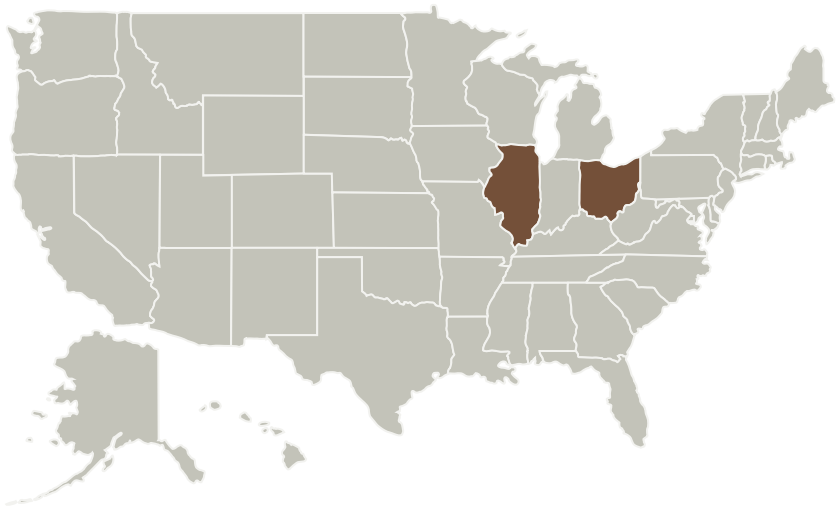
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ohio State University-Main Campus	Lead Organization	Academia	Columbus, Ohio
Ohio State University Office of Sponsored Programs	Supporting Organization	Academia	Columbus, Ohio
Ohio State University Research Foundation	Supporting Organization	Academia	Ohio
University of Chicago	Supporting Organization	Academia	Chicago, Illinois

Primary U.S. Work Locations	
Illinois	Ohio

Project Management

Program Director:
Michael A Garcia

Program Manager:
Dominic J Benford

Principal Investigator:
James J Beatty

Co-Investigators:
Scott P Wakely
Patrick S Allison
Kari Uhl

Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
  - TX13.1 Infrastructure Optimization
    - TX13.1.3 Commodity Recovery

Target Destination

Outside the Solar System